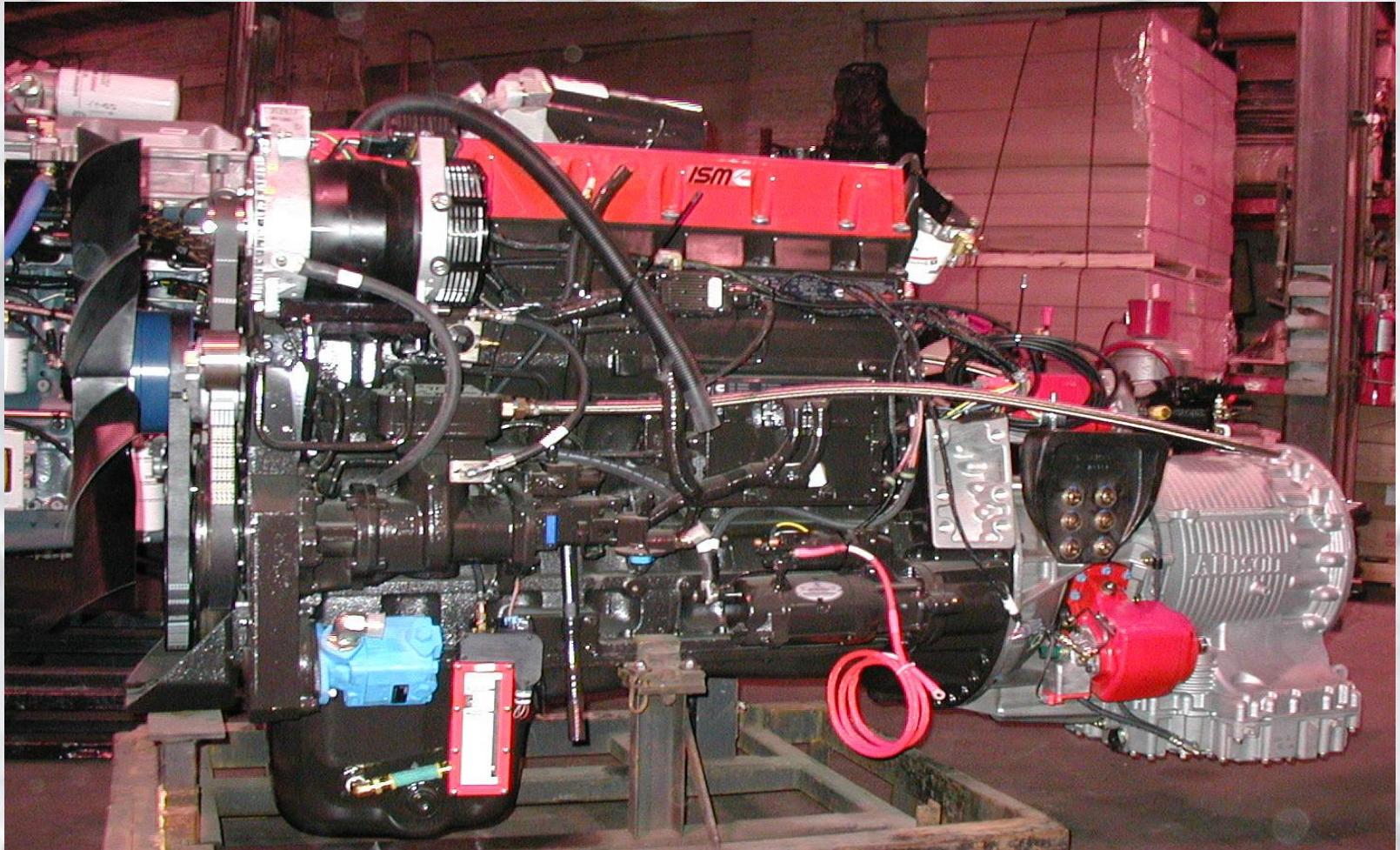


# Five Major Components of Fire Apparatus

**Apparatus Division**  
**Montgomery County Fire Rescue Services**  
**FF Jeff Bennett**  
**FF Donnie Allen**



# Engine & Transmission

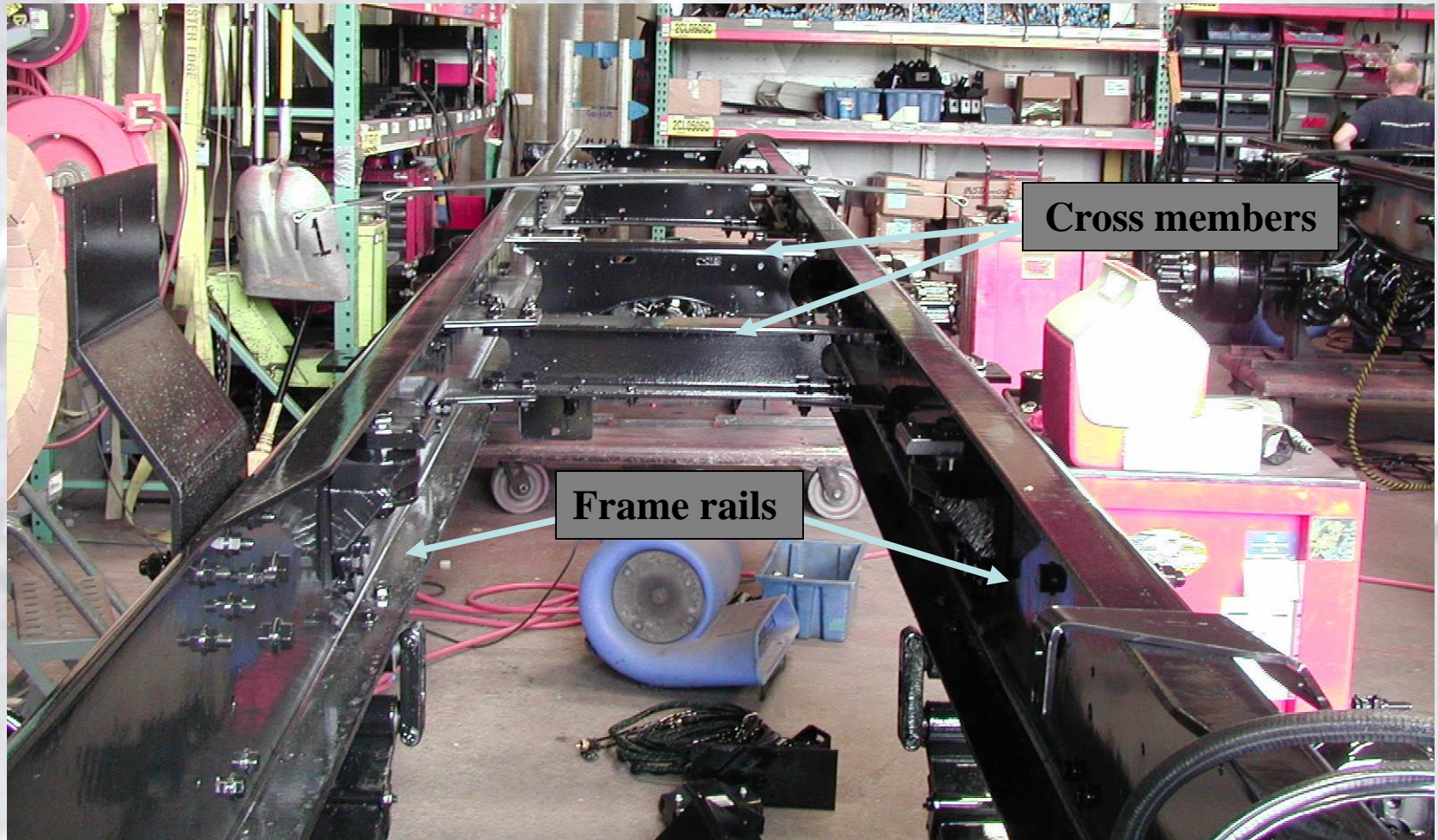


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Session 1-3





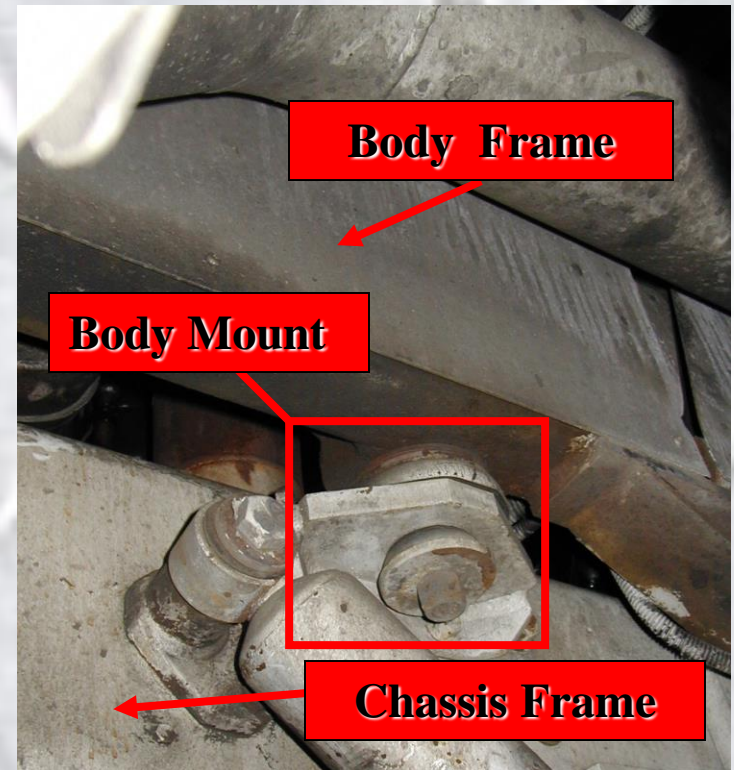
# Frame





# Cab and Body Mounts

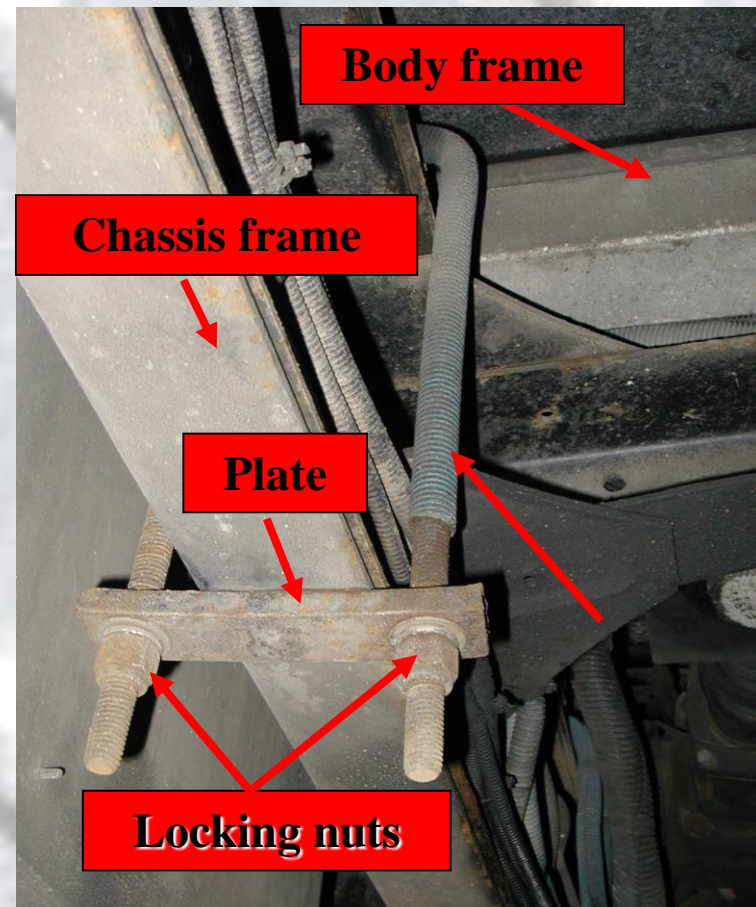
- Body mounts are used to secure the body to the frame.
- There are a few types in use
- The rubber cushioned has a center bolt. And rubber bushings sandwiched between
- The U-bolt type slips over the body frame and is bolted to the bottom of the chassis frame





# Body U - Bolts

- U – bolts hold the body to frame. The bolts are usually covered by a plastic sleeve.
- The following conditions warrant a OOS :
- A broken u – bolt
- Any missing locking nuts
- A Loose u – bolt that allows sliding on the frame
- A cracked or broken plate between u – bolt.



# Five Major Components

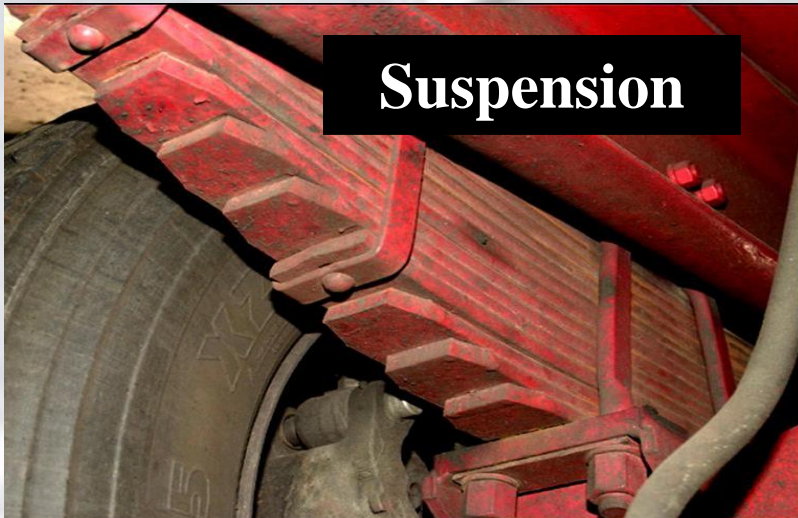
**Tires and wheels**



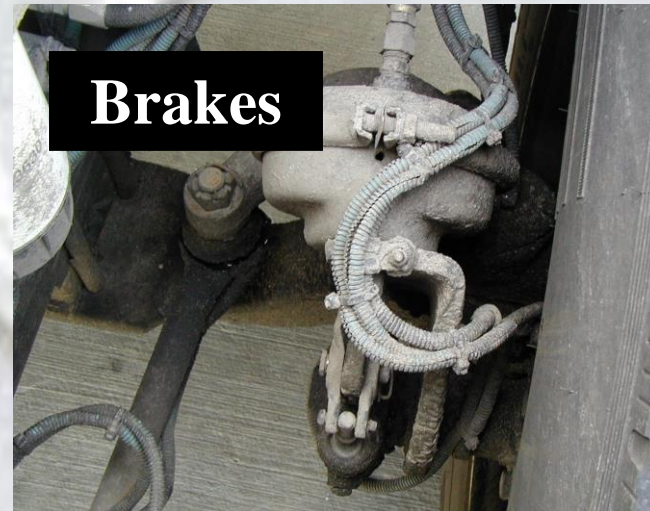
**Steering**



**Suspension**



**Brakes**





# **Why do we have to know the five major components ?**

- Knowing the five major components of the Apparatus we can identify and correctly write defect reports.
- Knowing the five major components and there working components helps determine normal and out of service conditions.
- Knowing all of the components by name help the mechanic understand what we are reporting.



# Tire's





# Tire's

- Does the tire have sufficient tread ? At least 4/32" inch of tread on steering axle's and 2/32" tread on non steering axles
- Are there cuts in the tread or sidewall that expose the cord of the tire ? If so the tire is out of service.
- Does the tire have a bulge in the sidewall ? If so the tire has a cord, sidewall separation and the tire is out of service
- Is the Tire properly inflated ? A under inflated tire is a overloaded tire and is out of service



# Tire's

- Does the tire capacity match the axle weight ?
- Does the tire's maximum air pressure match the wheels maximum air pressure ?
- Does the wheels maximum weight match the axle weight ?
- Are they certificate tire's
- Are they certificate wheels





# Wheel's



Single

Tubeless



Two piece

Flap & Tube

Three piece



# Wheel's

- What type of wheel is on the apparatus ?  
One piece, two piece, or three piece ?
- Is the wheel aluminum or steel ?
- Does the wheel show any signs of cracking  
at the hand holds or bolt holes ?
- Are all of the studs and lug nuts present ?  
Are they all hand tight ?





# Wheel Failures



# Wheel Covers



- Can this wheel be inspected ?
- What does the wheel look like behind this cover ?



# Wheel Covers



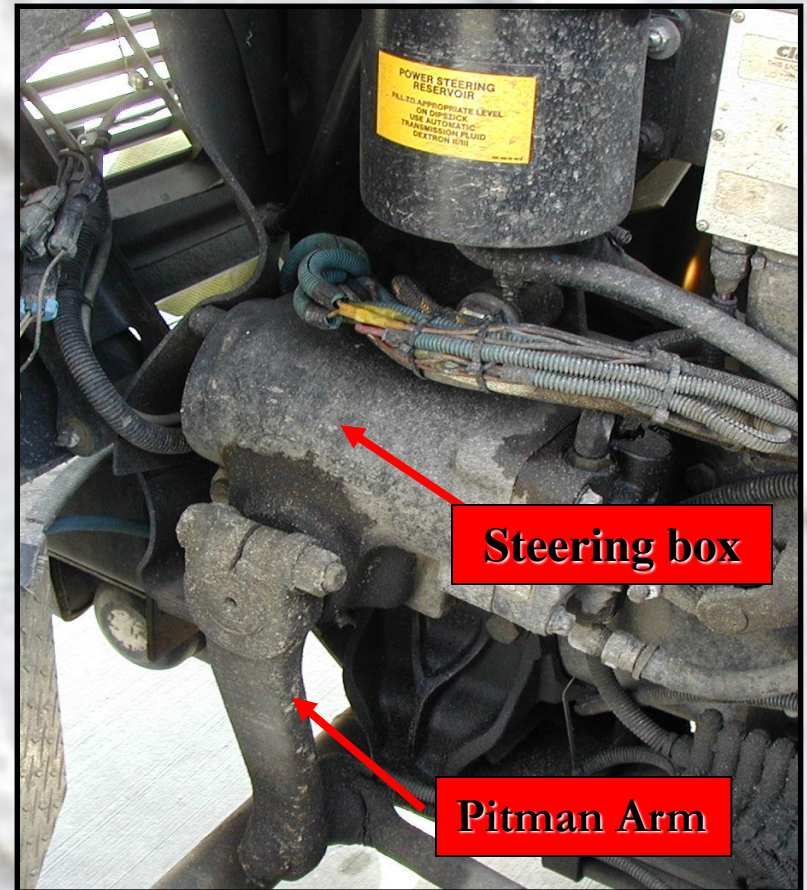
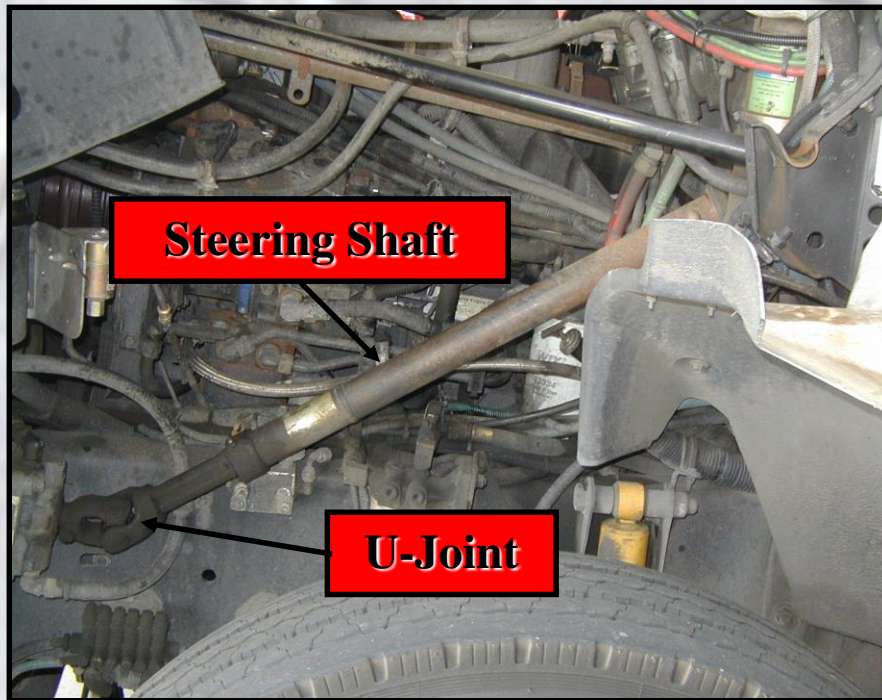
# Steering System

- Remember the order : Steering shaft to Steering Box. Steering output shaft to Pitman Arm. Pitman Arm to Drag Link. Drag Link to Steering Arm.
- Castle Nuts with locking pins hold the Drag Link to the Pitman Arm, and Steering Arm.
- Are all the parts secure ? And not bent, broken or missing
- Are there any class III leaks ?



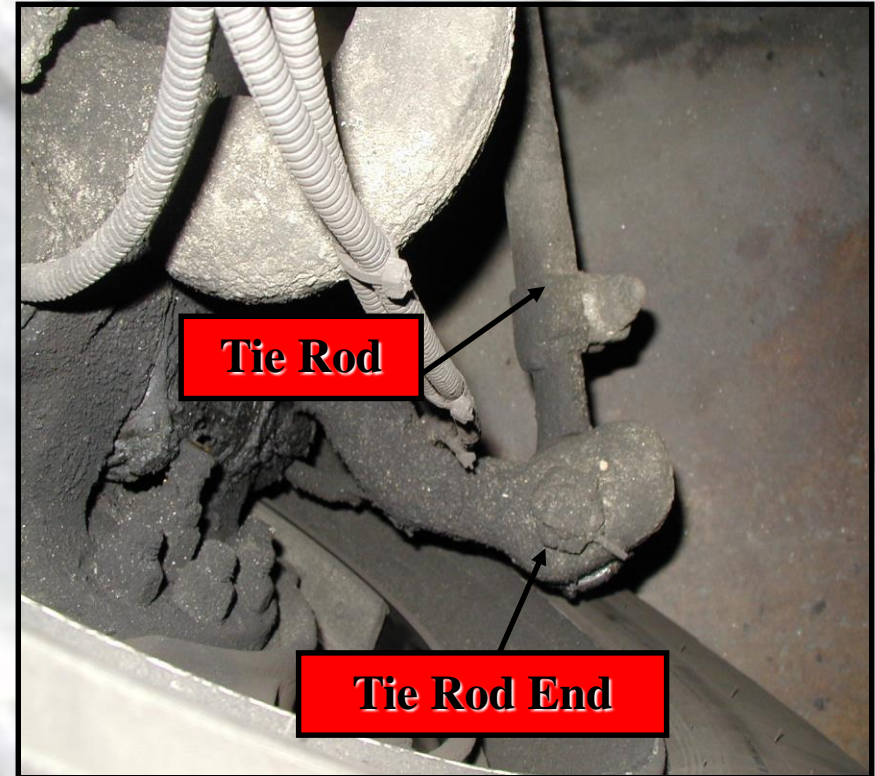
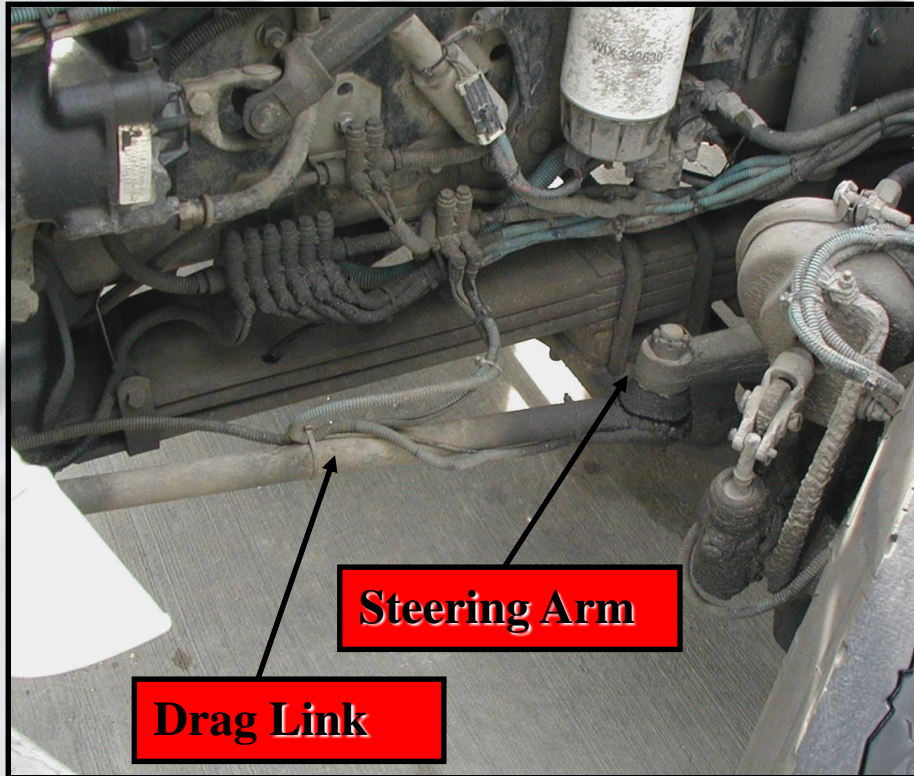


# Steering System





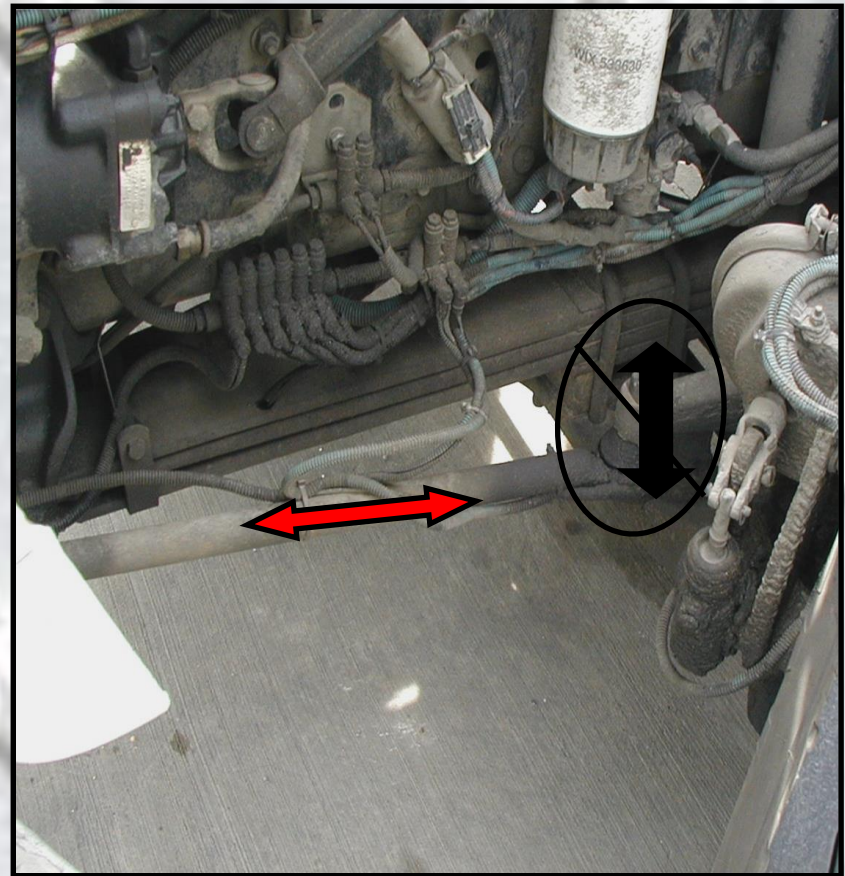
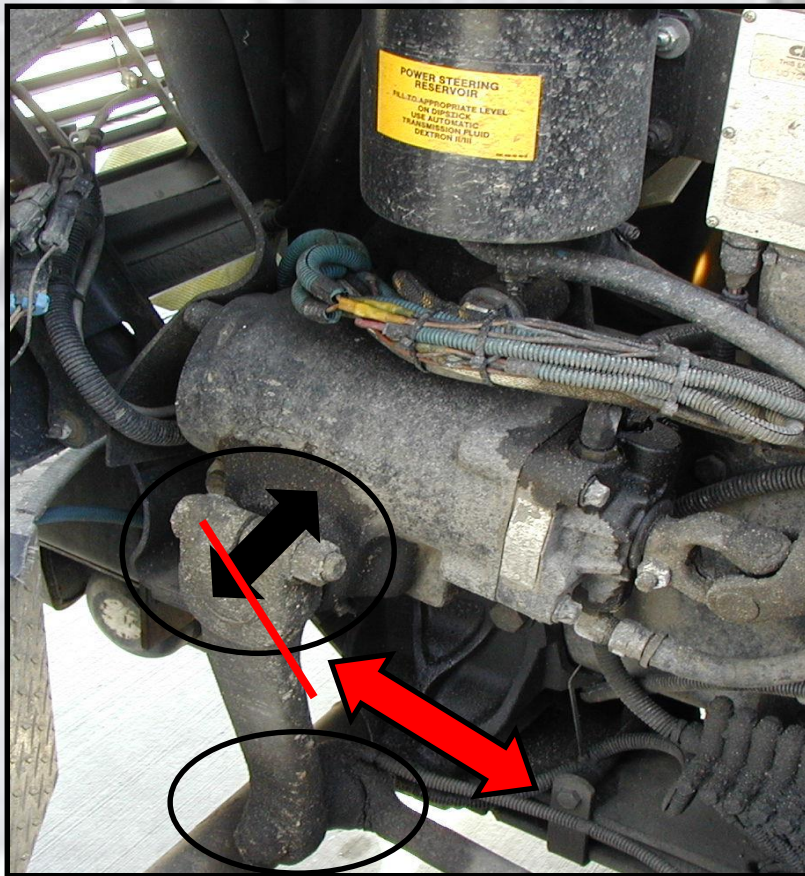
# Steering System





# Steering System

Normal motion =  Abnormal motion = 



# **Suspension System**

Why is the suspension system so important to us ?





# Suspension System



**Freightliner (OEM)**

**GVWR= 37,000lb**

**FRONT AXLE = 14,000lb**

**REAR AXLE = 23,000lb**

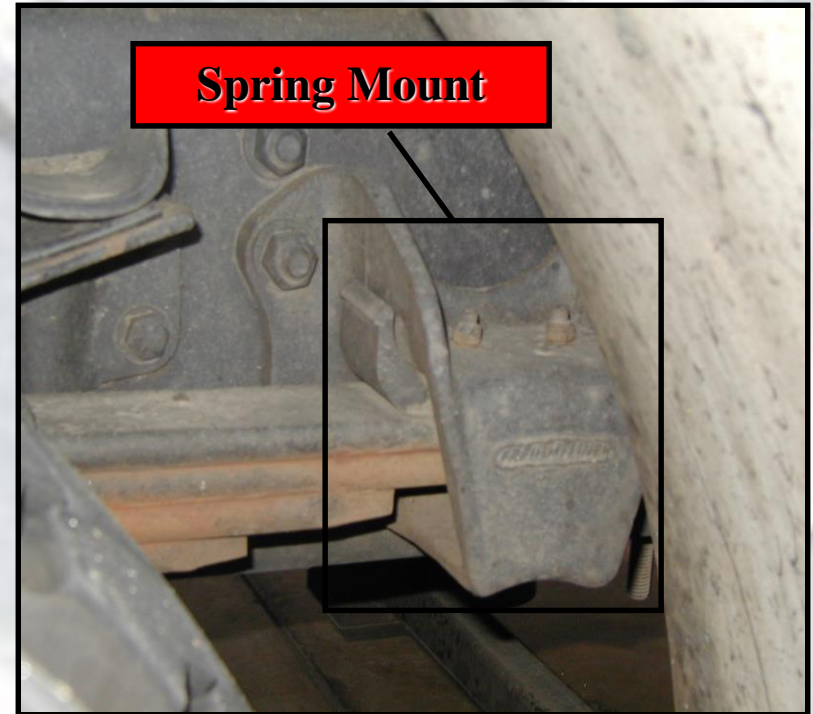
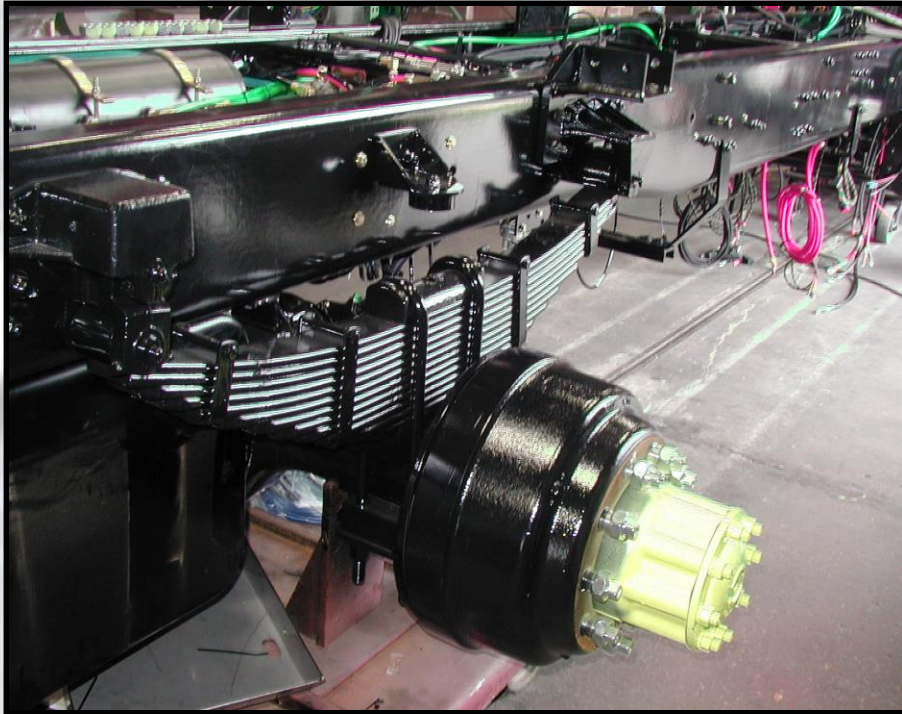
**ACTUAL**

**32,180**

**12,440**

**19,740**

# Spring Suspension



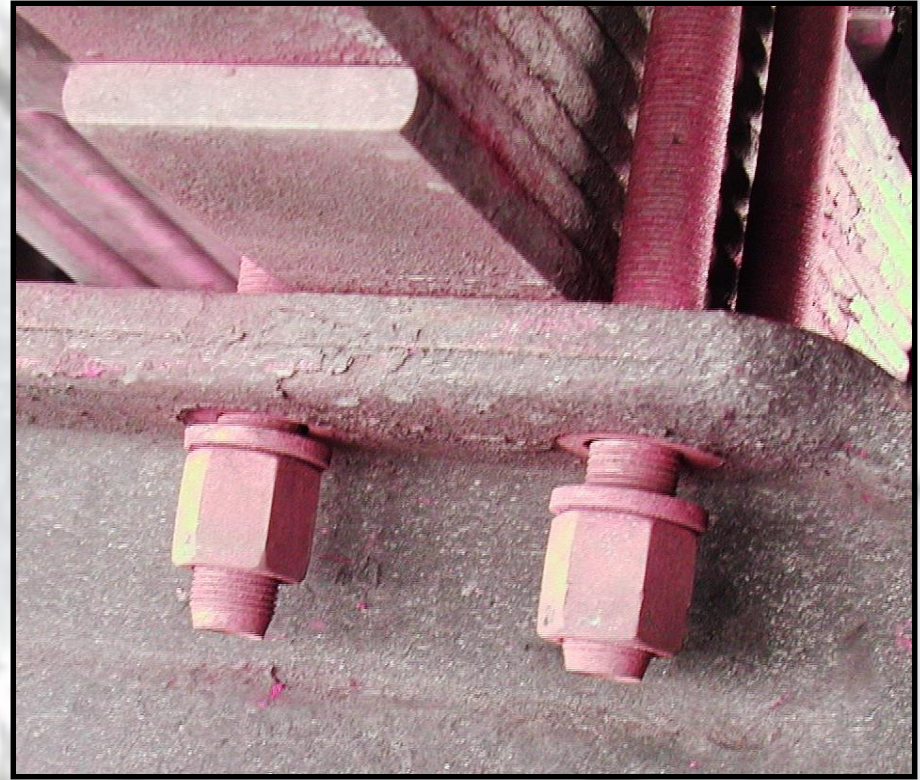
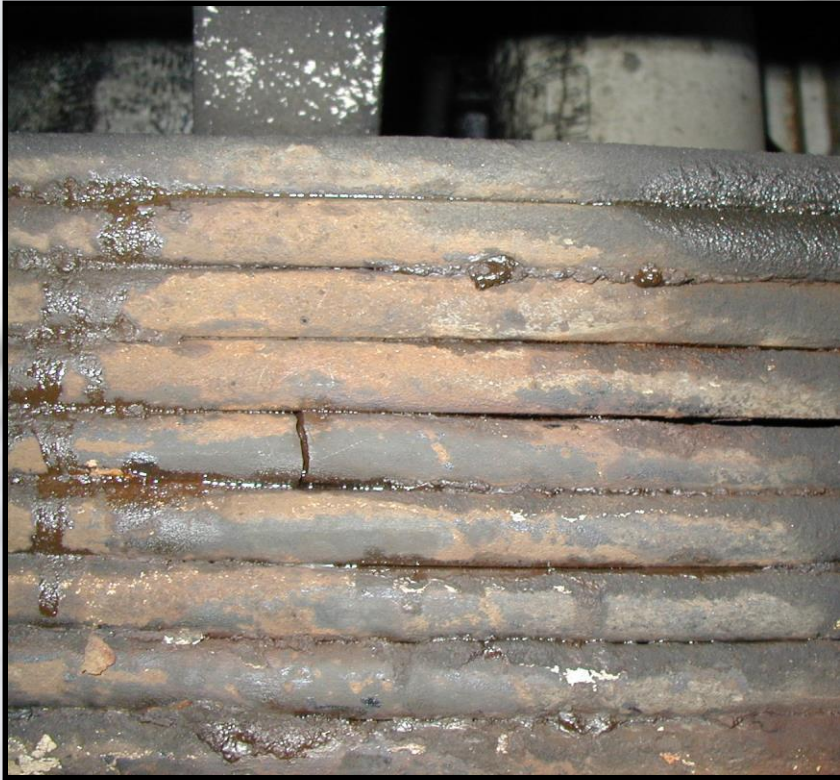


# **Suspension System**

- Are all of the bolts tight on the Spring Mount that hold it to the frame?
- Are all of the Leaf Springs intact ? Make sure the Leaf Springs are not missing, bent, broken or misaligned.
- Are the U –Bolts attached to the Axle, and are the locking nuts present and tight ?

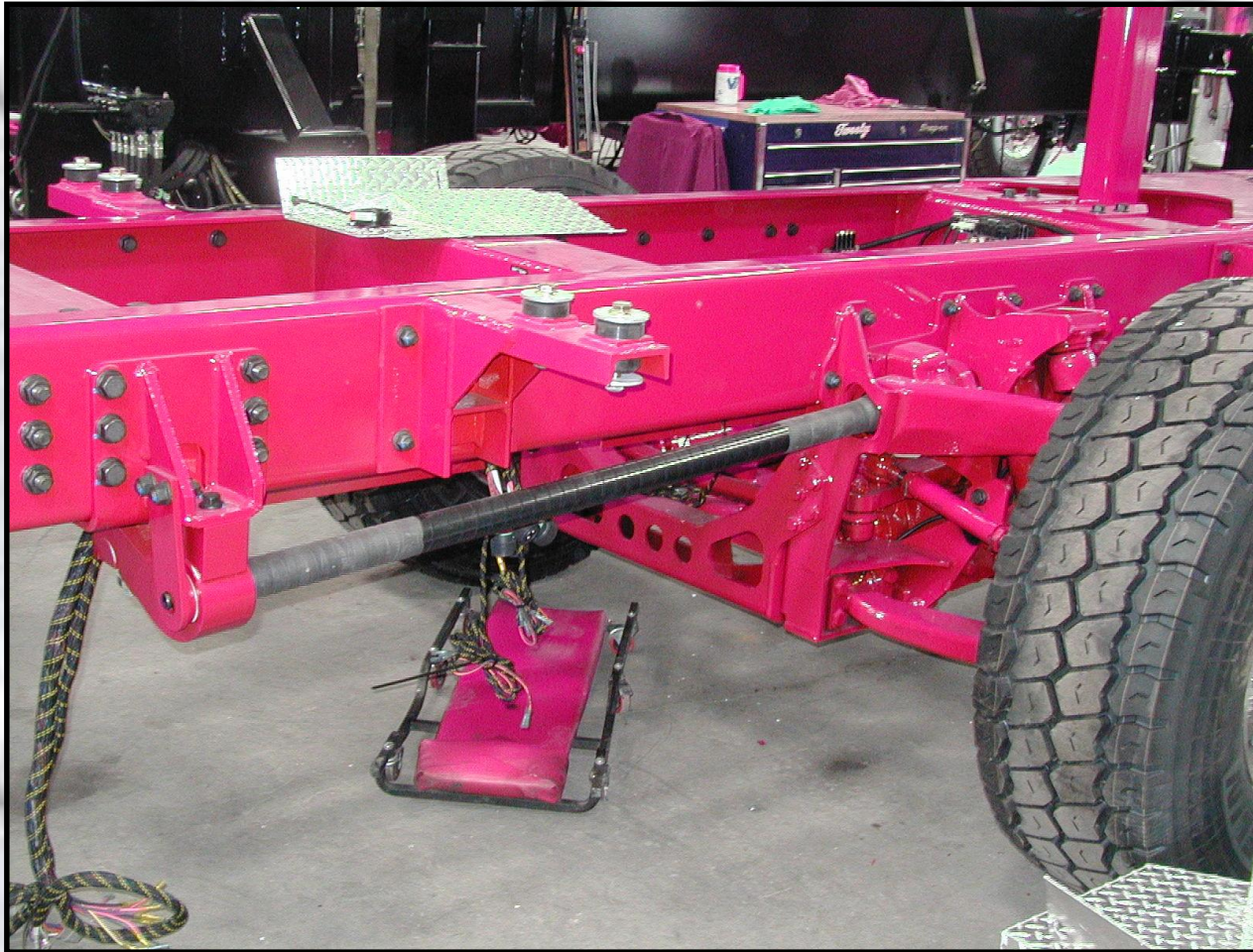


# Suspension System





# Tak – 4 Suspension

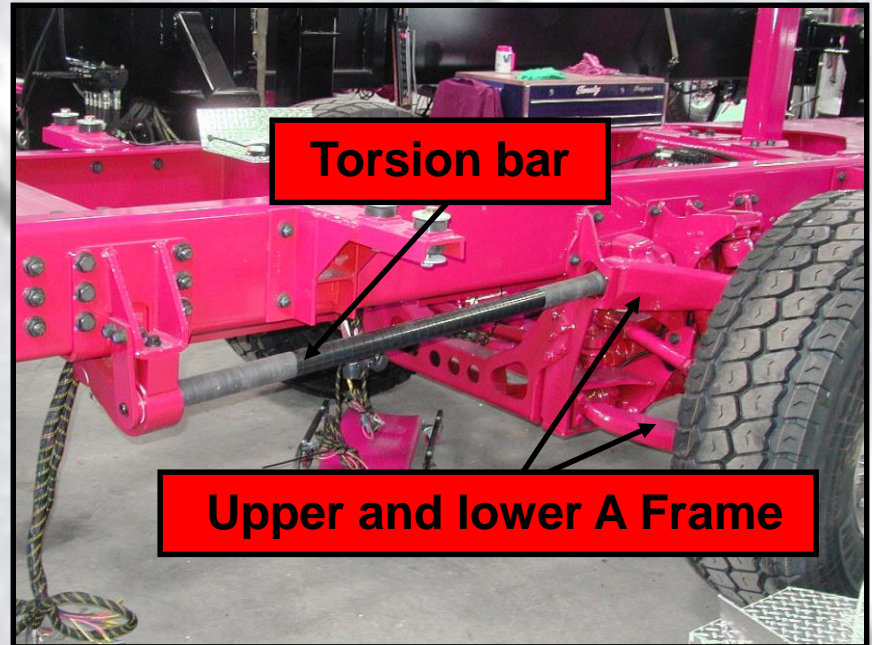


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Session 1-3





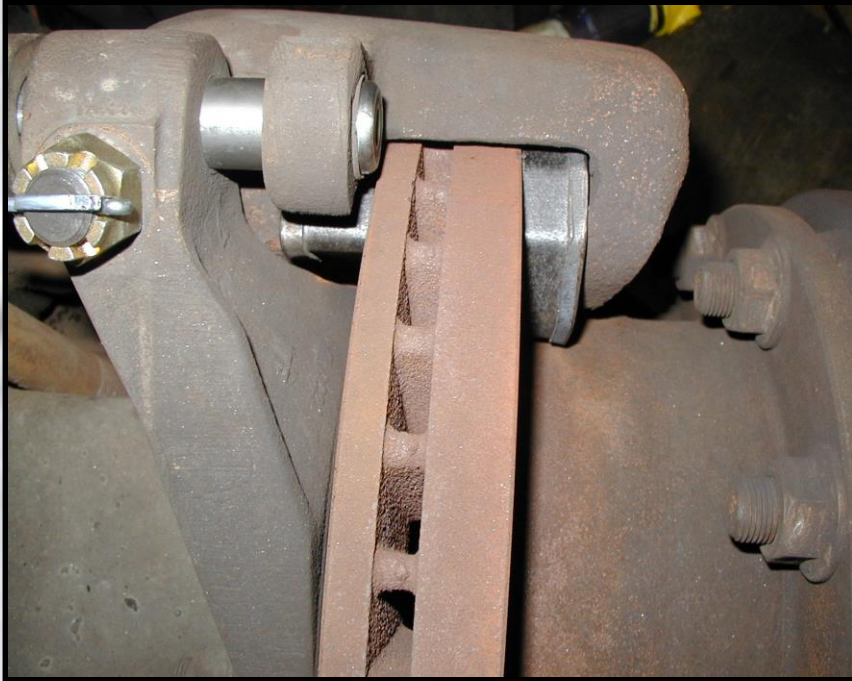
# Pierce-TAK4



- This is the Pierce-TAK4 suspension system.
- The Pierce-TAK4 suspension is a torsion bar system, with a upper and lower A-frame assembly. It has a shock absorber for wheel control.



# Braking System's



# **Functions of the Braking System**

- When you start the engine and the air tanks are empty the following occurs.
- The compressor starts to make air, this is known as loading the compressor. Compressor's can be belt or gear driven.
- The air leaves the compressor and travels to the air dryer. When the air enters the dryer oil and water moisture are removed and the air continues into the supply or wet tank.
- The air then travels to the primary tank which controls the rear brakes, or into the secondary tank which controls the front brakes.
- The other air tanks are for accessory items or reserve tanks.
- When the air tanks become full it triggers the Air governor to stop the compressor from making air and puts the compressor in a unloaded state.
- It also triggers the air dryer to purge itself cleaning the cartridge and dumping the moisture.





# **Functions of the Braking System**

## **S-Cam drum**

- When the truck is parked and the parking brake is applied, the truck is being held in place by spring brakes. These springs apply approximately 1500 hundred pounds of force.
- When you release the parking brake you apply air pressure pushing off the spring brake.
- When you apply the brake on a normal stop you are using the service brake. You are applying air to all four chambers.
- The primary air system takes care of the rear brakes, and the secondary system takes care of the front brakes
- When you apply the brake air leaves the reservoir tanks and enters the brake chambers at the applied pressure, when you release the brake air is exhausted thru exhaust ports.



# Functions of the Braking System

## S-Cam drum

- When applying the brake air pushes on the diaphragm moving it forward which in turn pushes the pushrod forward.
- If you have a 30 inch diaphragm and are applying 50lbs. Of air pressure, you are applying 1500lbs of force to the pushrod.
- The pushrod pushes on the slack adjuster which is no more than a mechanical lever and turns the s-camshaft in the wheel.
- You have 1500lbs. pushing on the slack adjuster which is 6 inches in length and now you have 9000 lbs of force on the s-camshaft
- The s-camshaft rotates forcing the brake pads into contact with the brake drum.
- When you leave off the brake return springs in the wheel, and brake chamber, return the brake to normal position





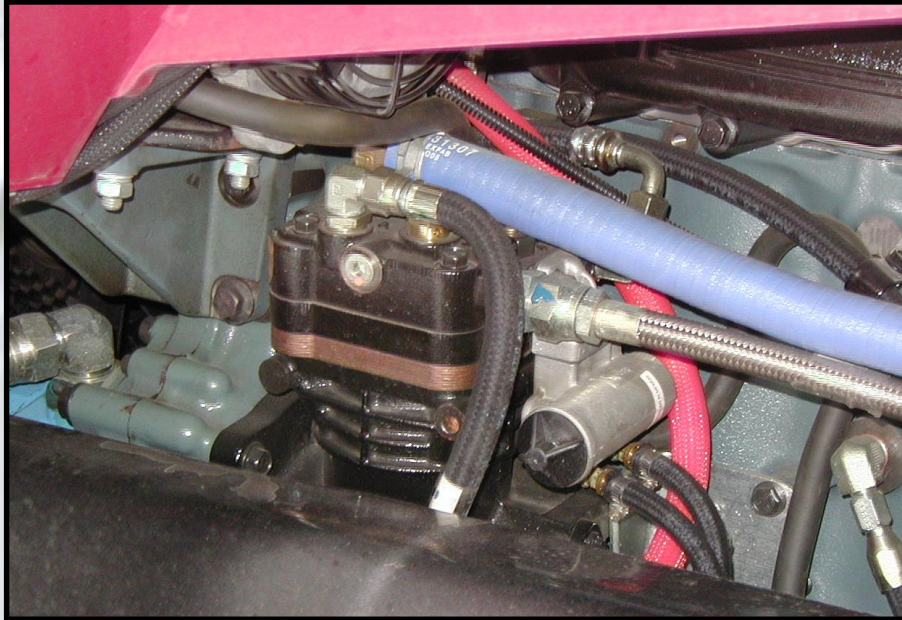
# Functions of the Braking System

## Disc brake

- Air disc brakes work like drum brakes except they squeeze on a rotor from both sides.
- Instead of having a s-camshaft they have a power screw.

# Air Supply & Dryer

## Air Compressor



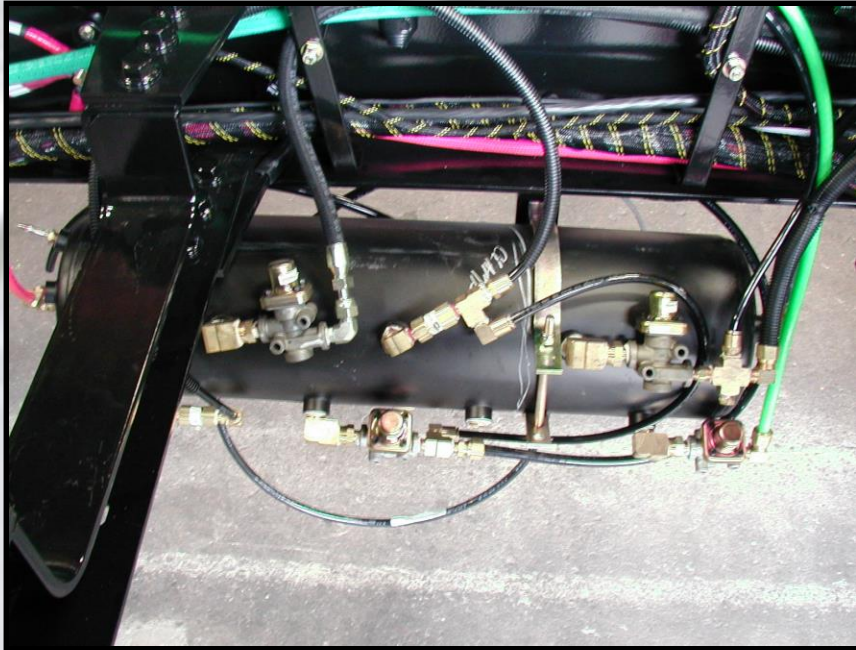
## Air Dryer



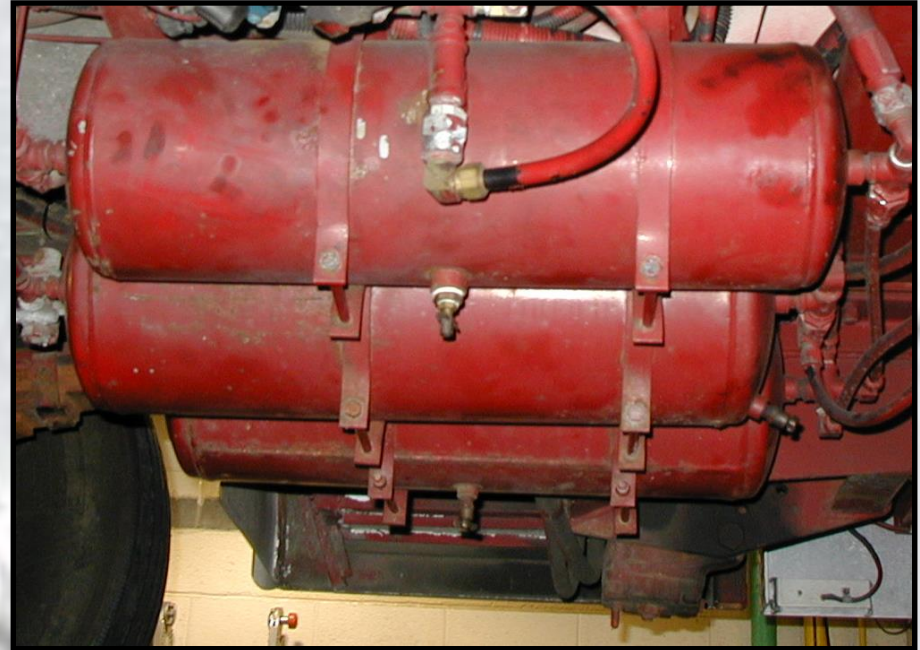


# Air Storage

## Supply Tank

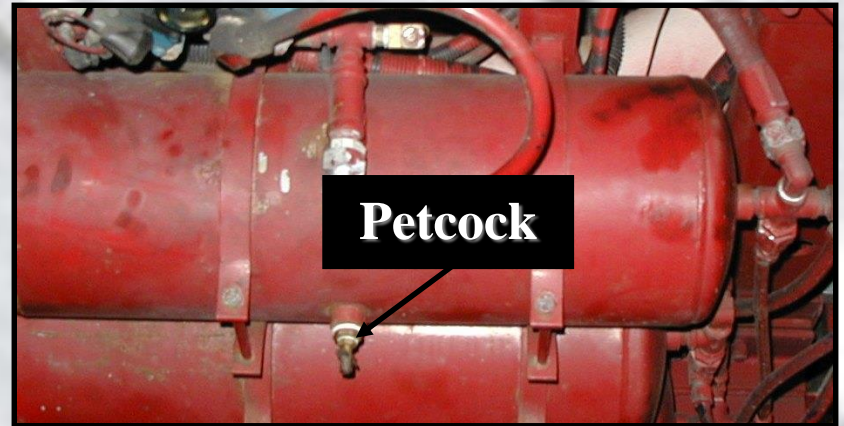
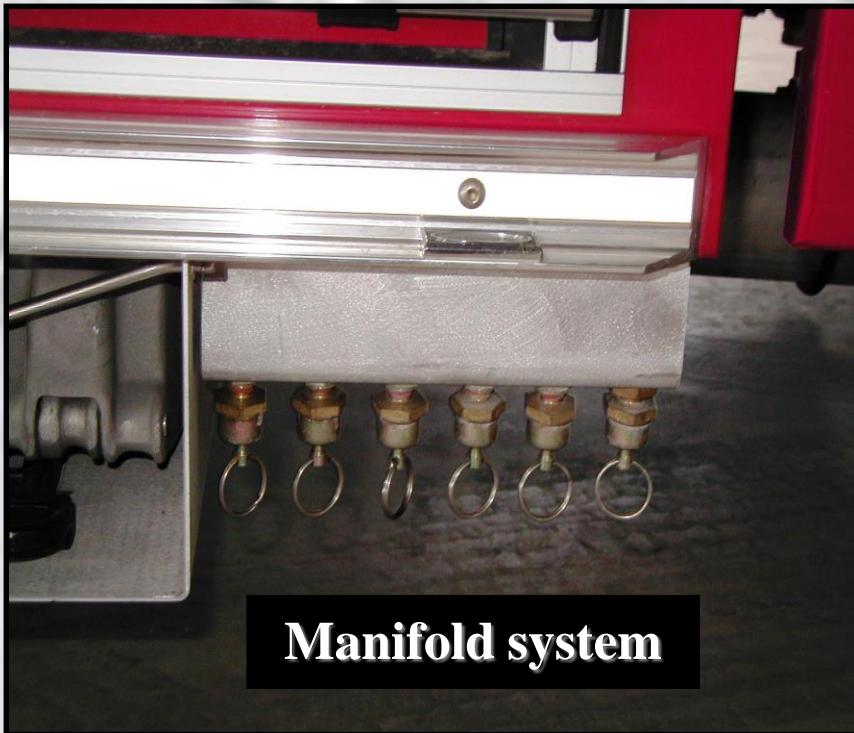


## Storage Tanks



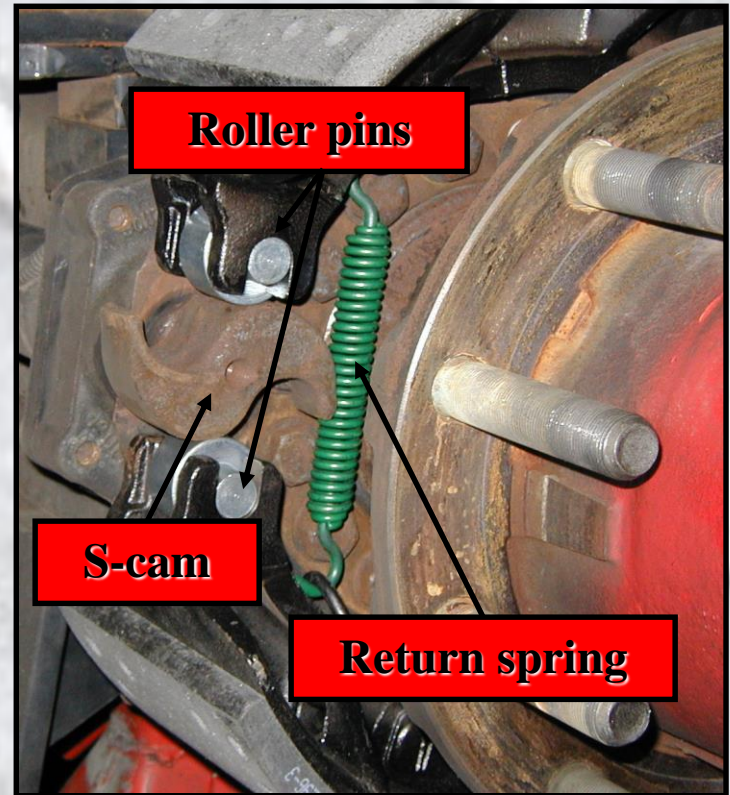
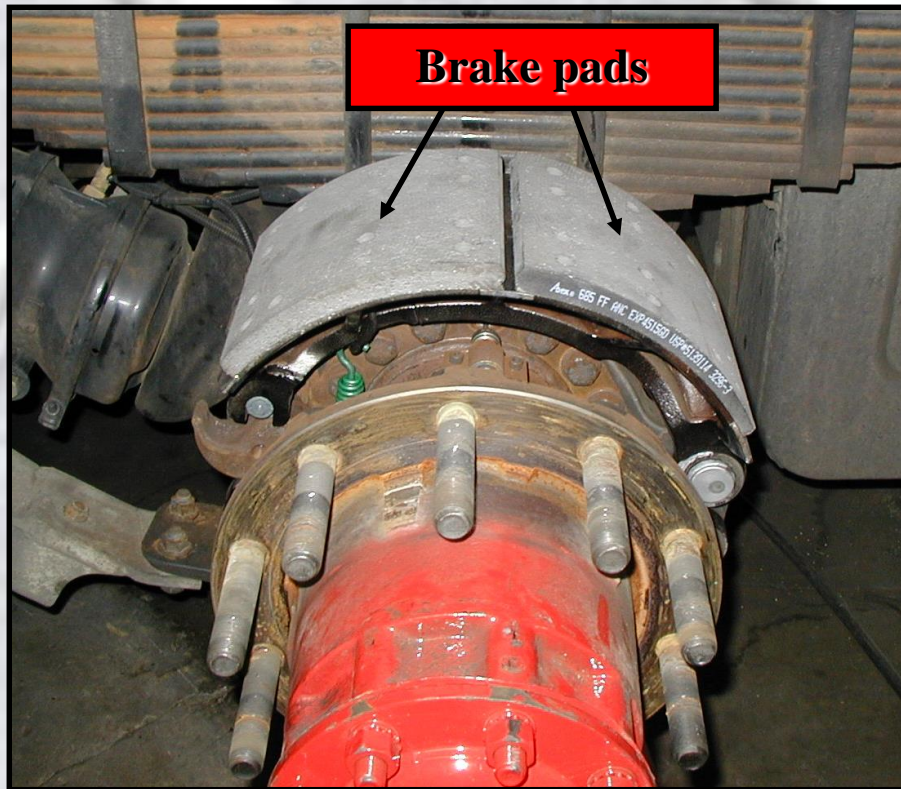
# Brake Components

## Types of Air bleeding systems



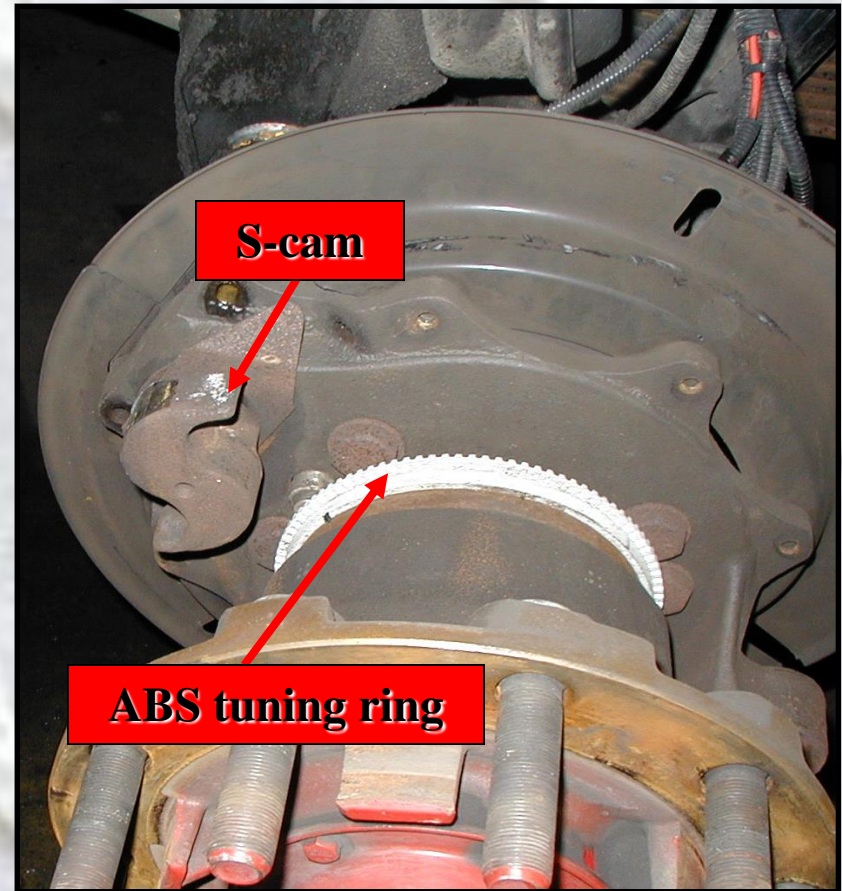
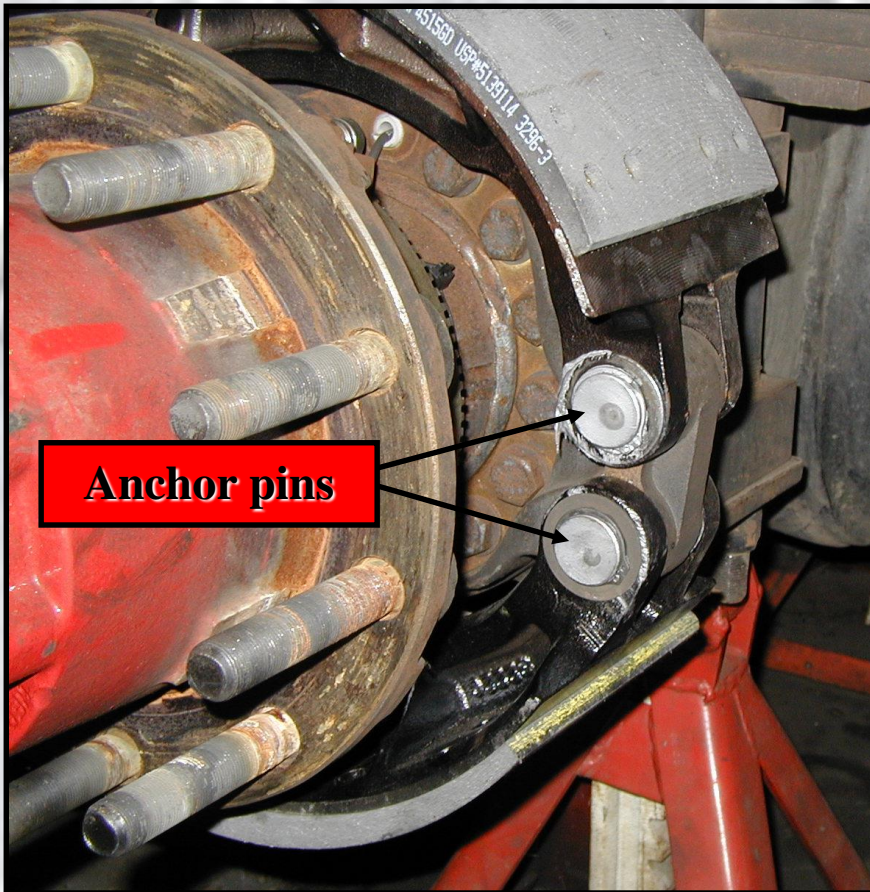


# Brake Components



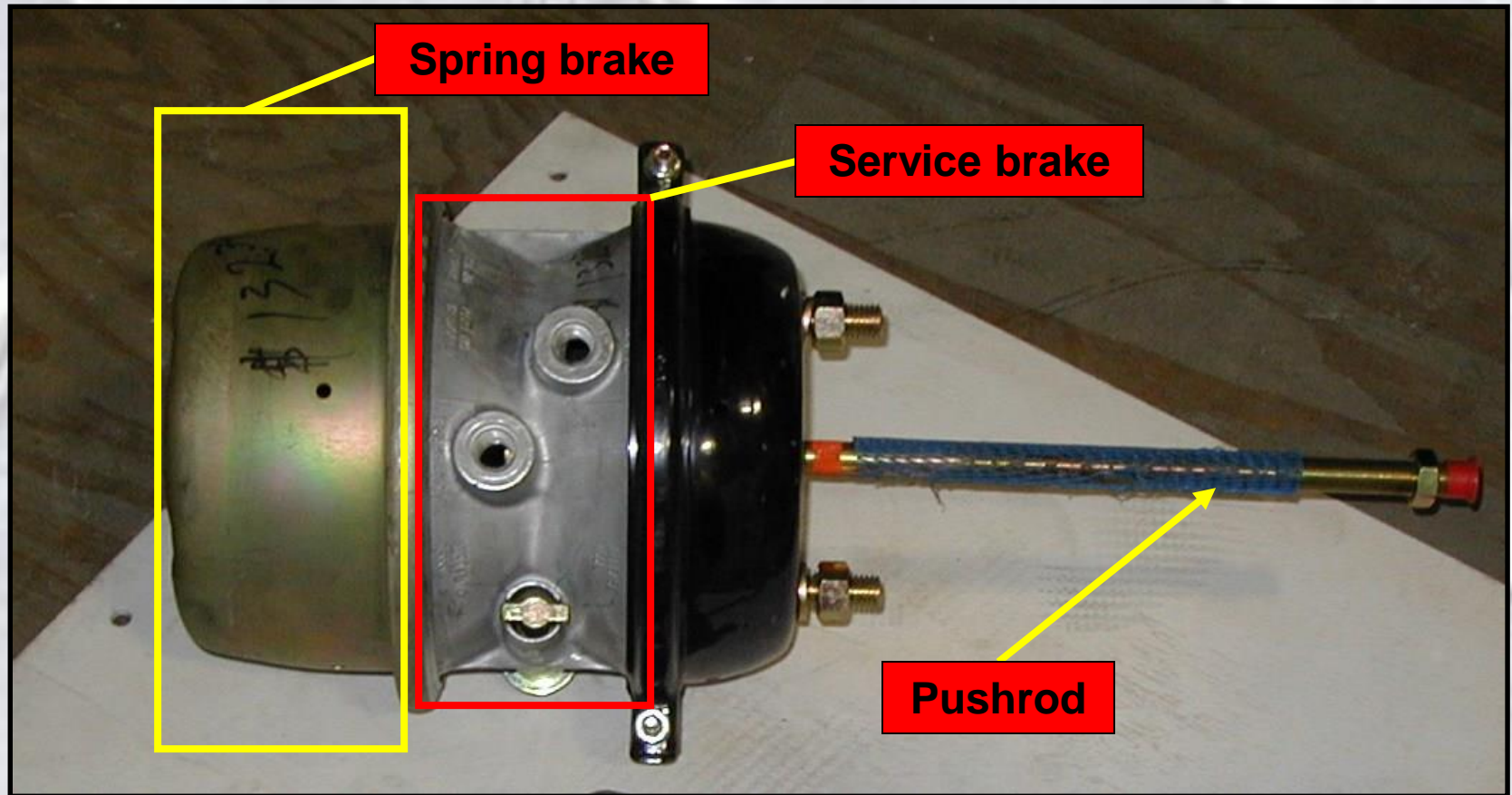


# Brake Components

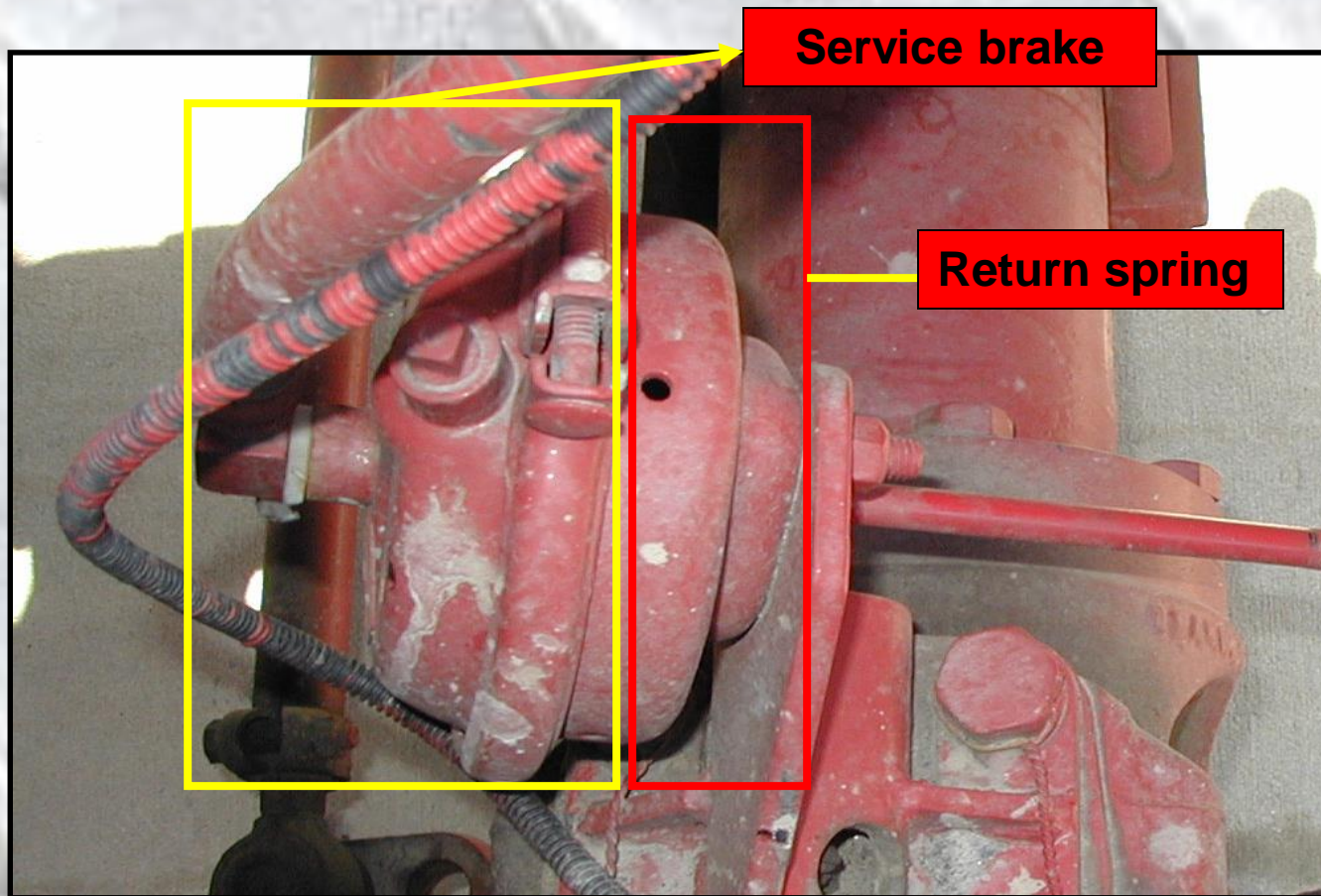




# Double Chambered



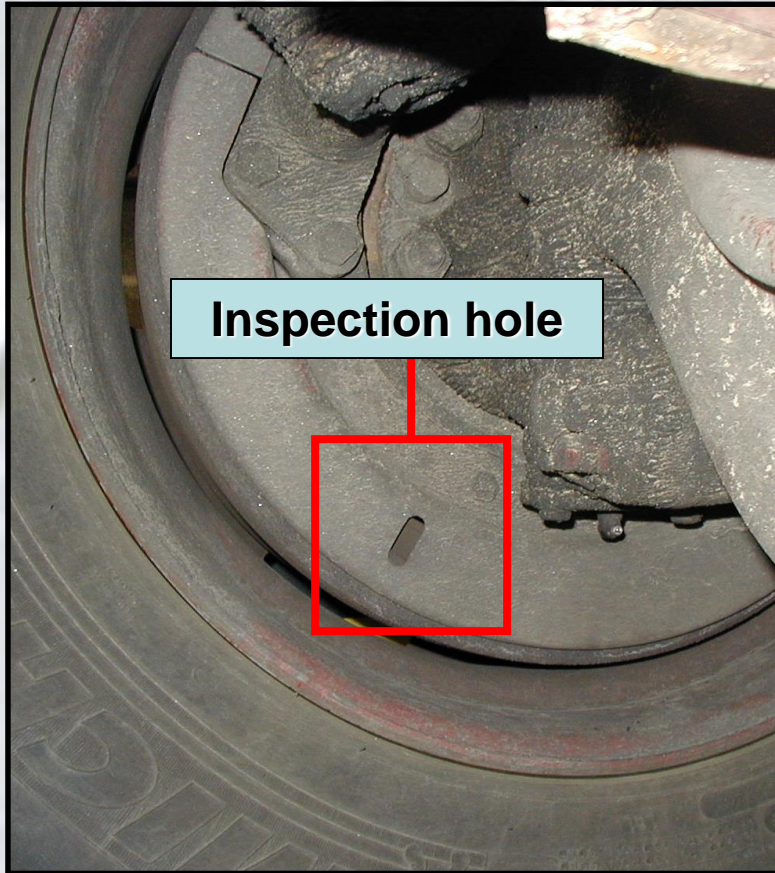
# Single Chamber



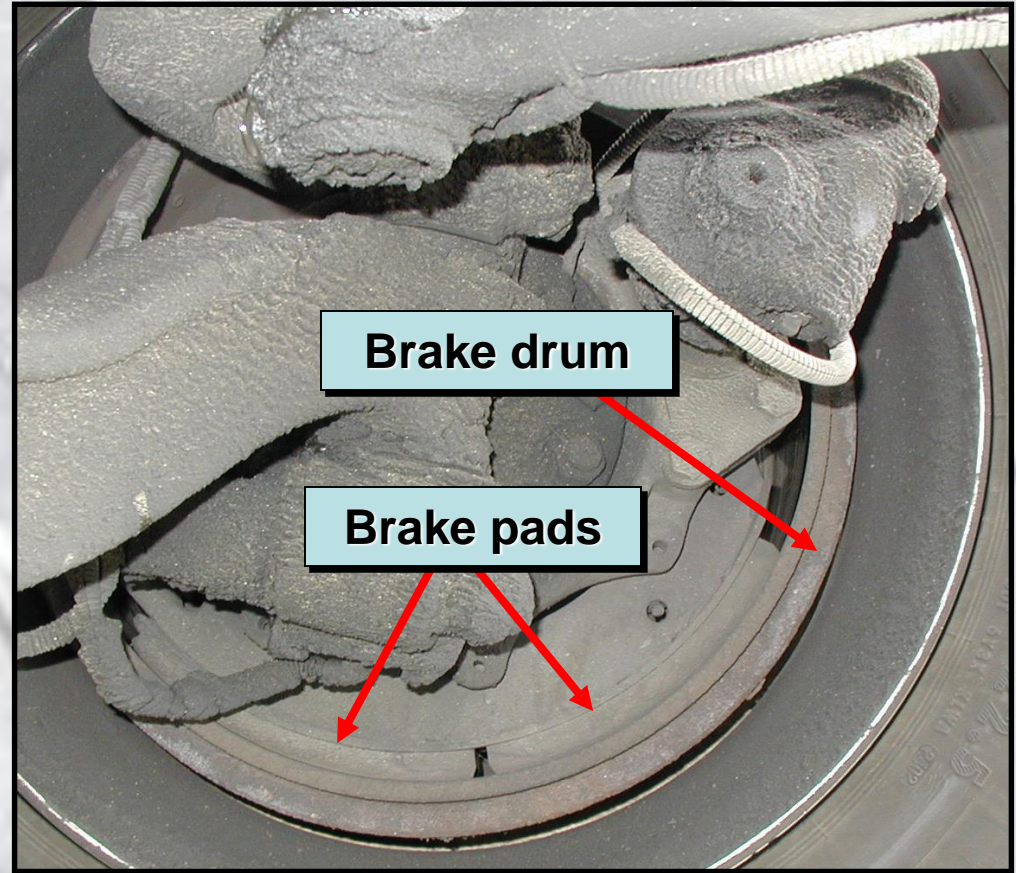


# Brake Pads

Dust covered wheel

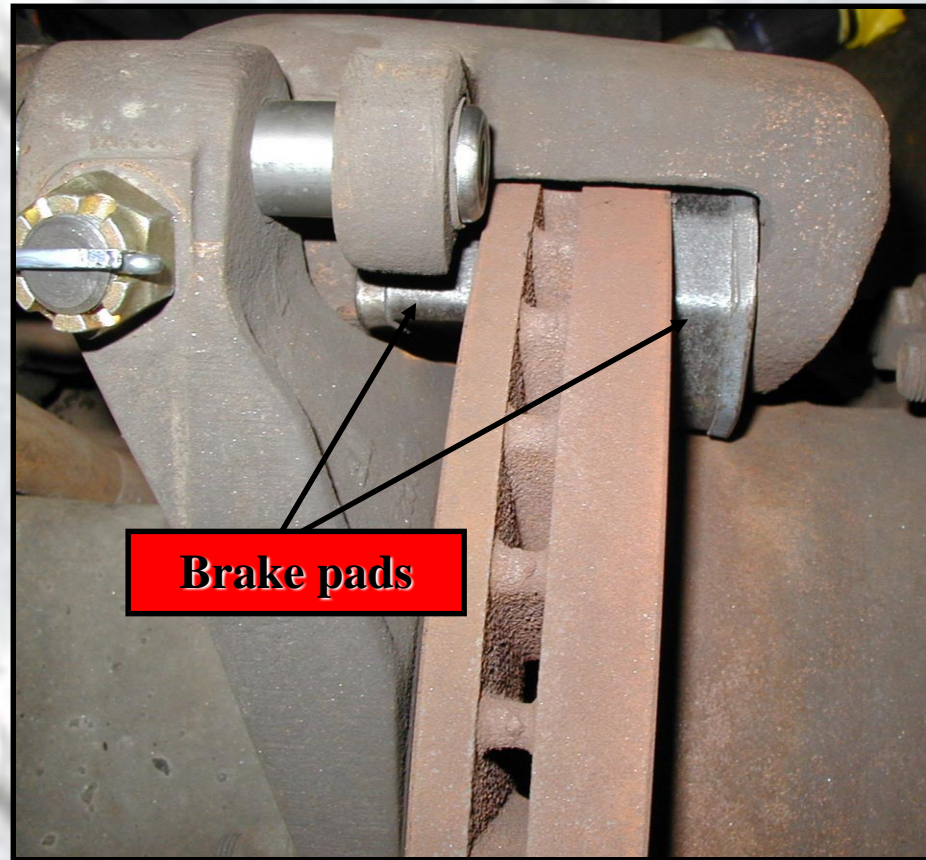
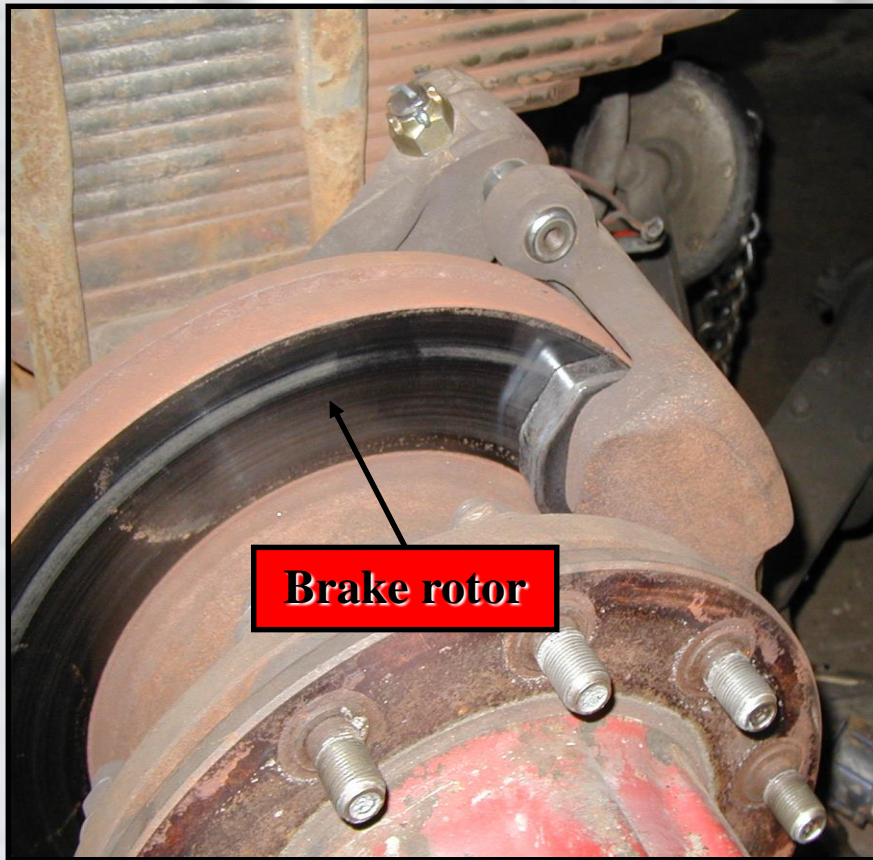


Open wheel



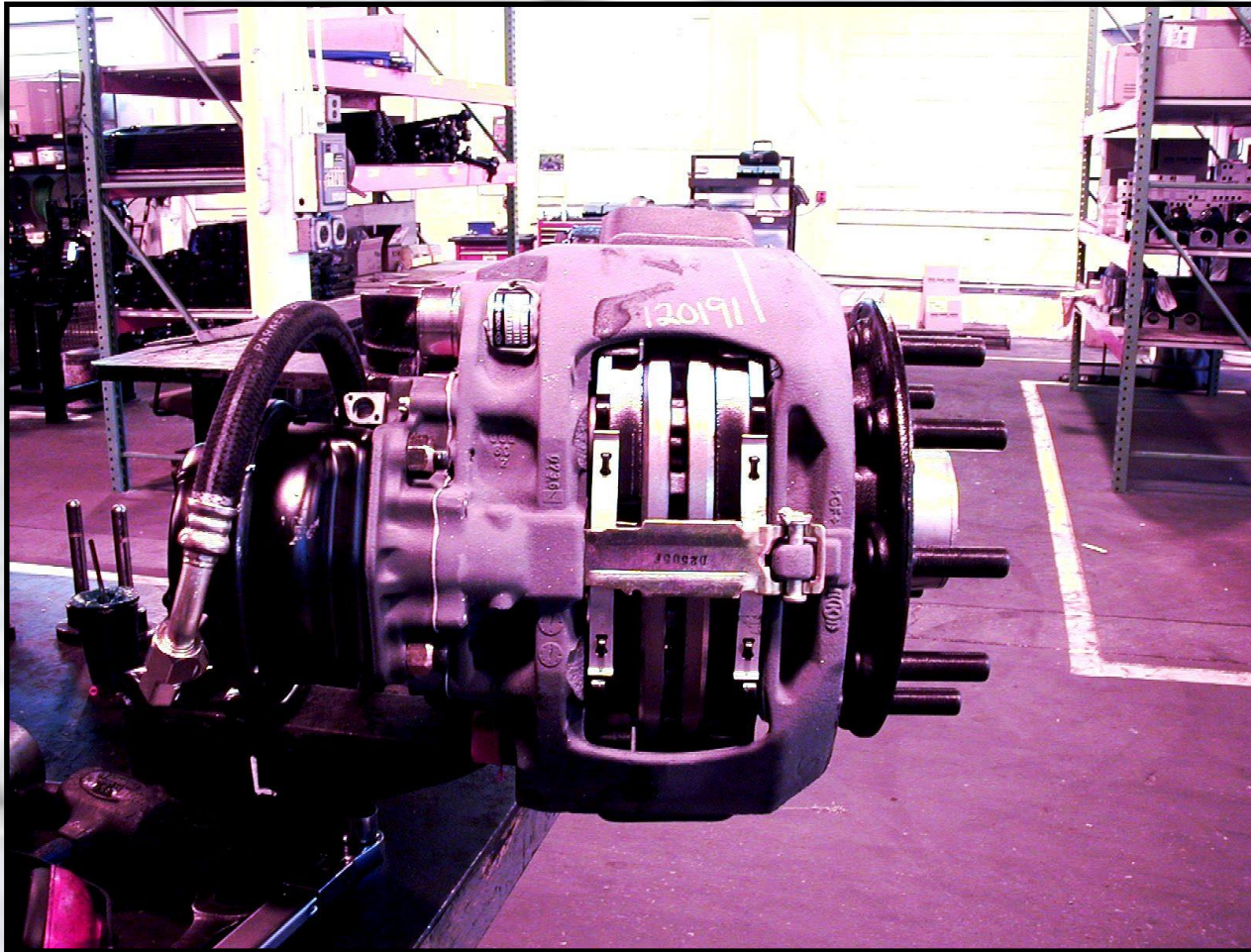


# Disc Brake





# Knorr – Bremse (Bendix)



Class "B" Driver Course  
Session 1-3



# **Braking System**

- What type of brake is on the apparatus ? Are they Disc brakes, Drum brakes, or a combination of both types ?
- Are the Drums or Disc present and intact ?
- Is there at least ¼” of brake pad and are they free from oil and grease.
- Is the air line to the brake chamber intact ? Is the air line cut or rubbed ?
- Do you hear any air leaking at the brake chamber ?





# **Braking System**

- How many air Tanks are on the Apparatus ?
- When were the tanks drained last ?
- When the Air Compressor kicks off what does the air dryer Spit ? Is it a clear spray or is it oil ?
- When does the Air Compressor shut off ?
- When does the compressor start ?
- When does your low air warning devices activate ?
- When does the protection valve activate ?



# Air Brake OOS Criteria

- The following defects and deficiencies of the air brake system reduce the operational safety and performance of the fire apparatus and shall be considered when placing the apparatus out of service. Use the prescribed test procedure for a commercial driver's license to assist with determining out of service condition.
- Service brakes that have an air pressure drop of more than 3psi in 1 minute for a single unit or more than 4psi in 1 minute for a combination unit, with engine stopped and service brake released.
- Leak down rate (time) of the applied side of the air brake that is more than 3psi in 1 minute for a single fire apparatus or more than 4psi in 1 minute for a combination fire apparatus, with the engine stopped and the service brake applied



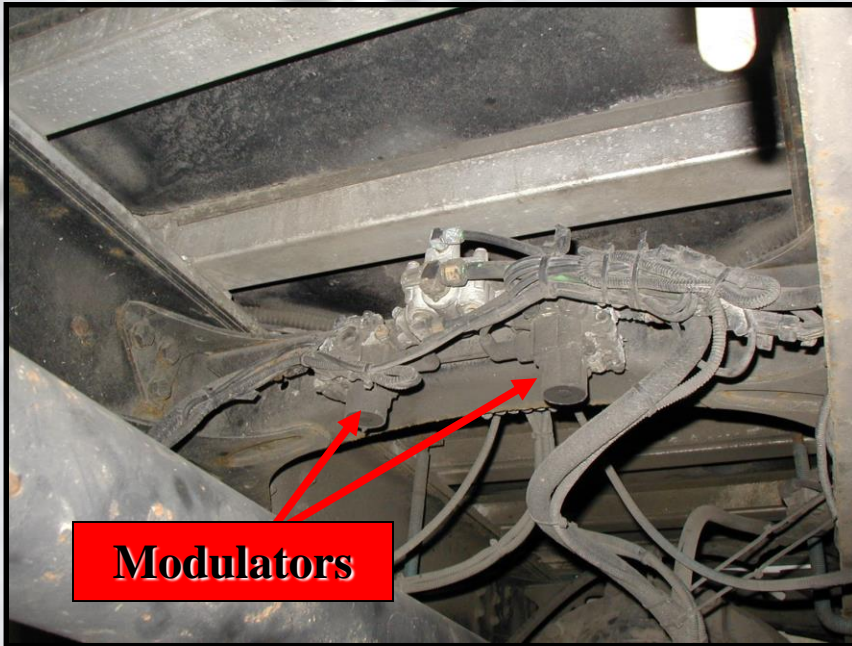
# Air Brake OOS Criteria

- Air compressor that fails to fill the air system to the air compressor governor cutout pressure with the service and parking brakes released
- The cut out pressure should not exceed 140psi
- The cut in pressure should not be less than 90psi
- Antilock braking system (ABS) warning indicator that is activated upon checking chassis operator's manual to determine the indicator's light's meaning. (The warning indicator generally indicates that the ABS is inoperable and the vehicle should be driven as such)

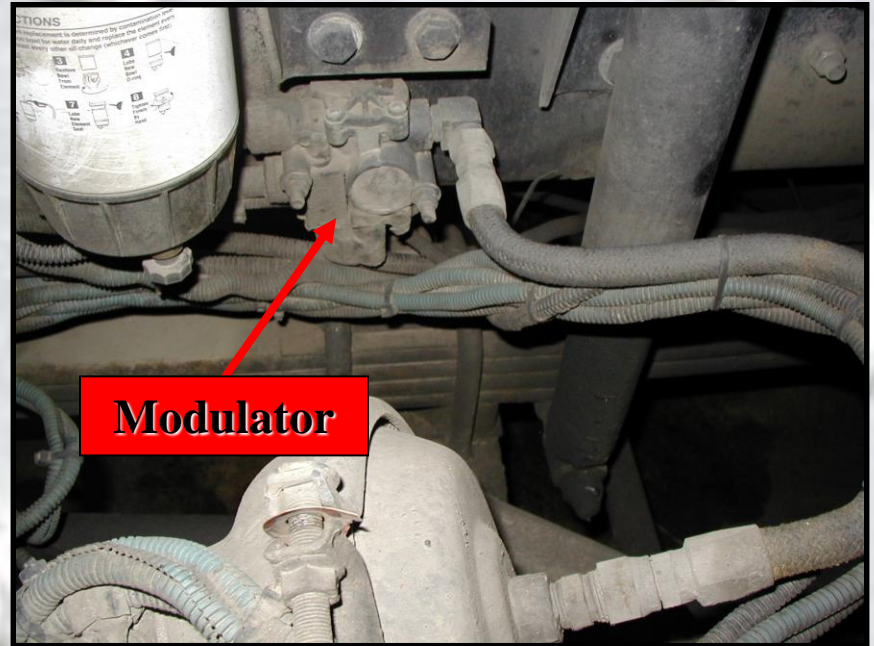


# ABS System

**Rear**



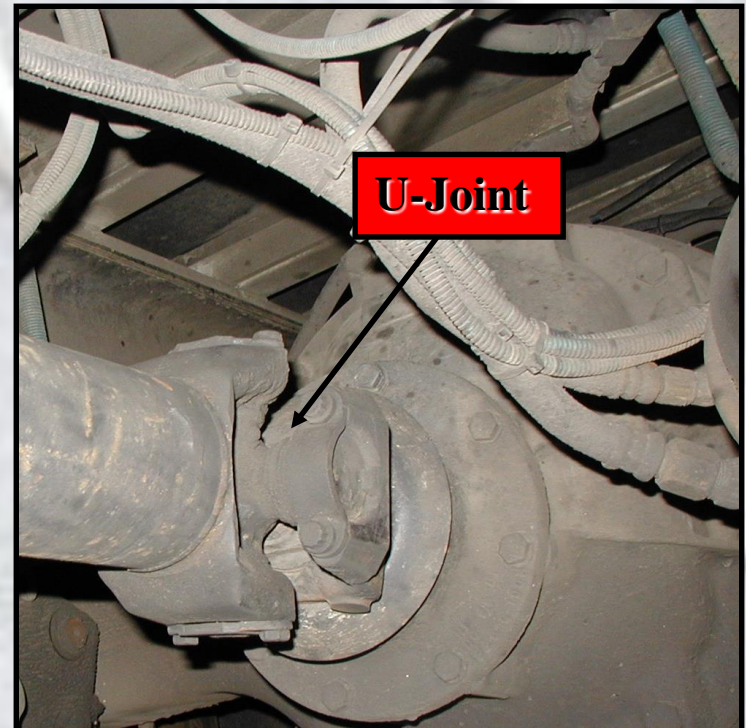
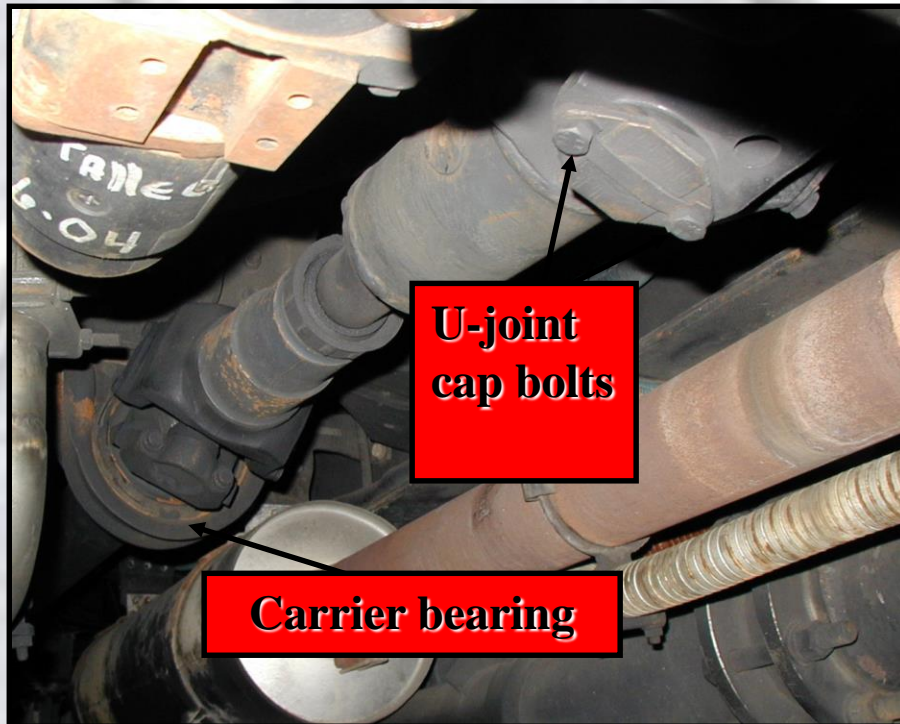
**Front**



■ Modulators can be found on cross members or frame rails



# Drive Line Components



- Are all bolts in U-Joints, and are they tight ?
- Are all bolts in the carrier bearing ?

# D.O.T Brake Test

- This brake test must be preformed in this order
- Out of order sequence will result in failure !!!!
- Before you begin this test be sure that the wheels are chocked.
- Make sure battery and ignition is on so gauges will read, and warning devices will sound





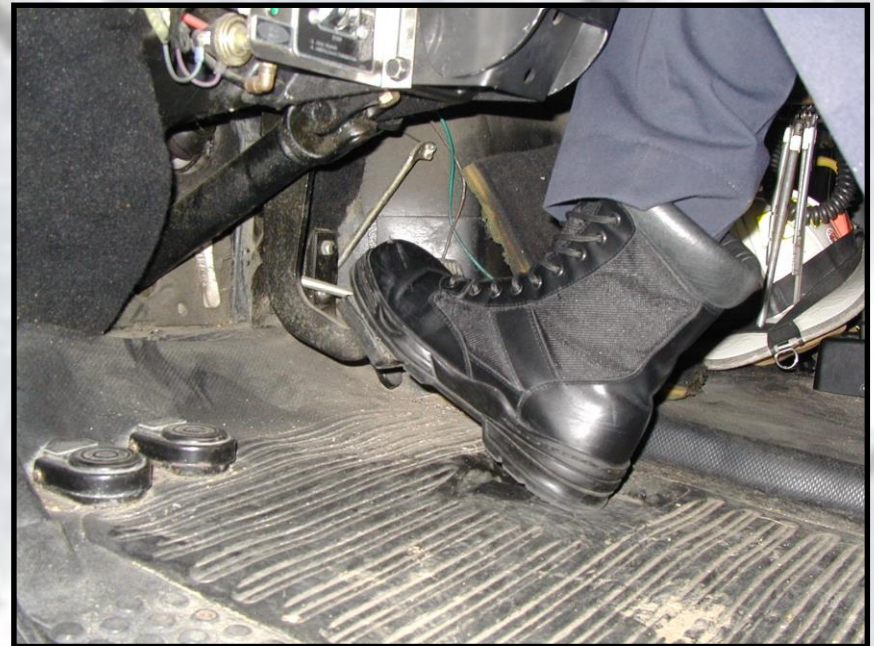
# D.O.T Brake Test

- Push Protection valve in charging the system
- Let tanks settle
- Tell instructor you are going to watch the gauge for 1 (one) minute.
- You are looking for air loss no greater than 3psi in one minute. (4psi for tiller trucks)
- Ask instructor to time you if you have no watch



# D.O.T Brake Test

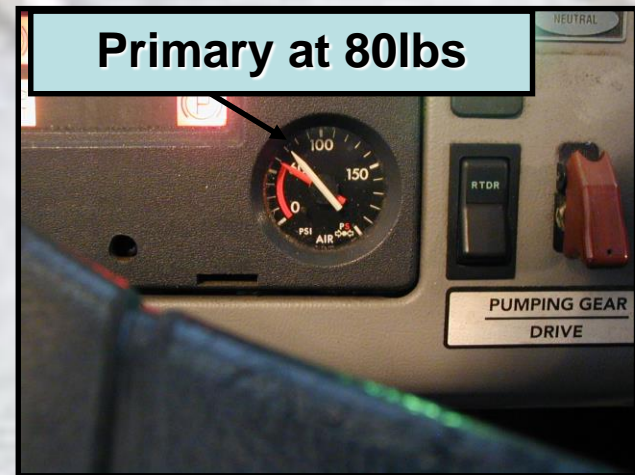
- After one minute you will now move to the next step
- Put your foot on the brake pedal and apply and hold steady pressure
- After tanks settle, time for one minute.
- You are looking for air pressure loss of no more than **3psi** in one minute. (**4psi for tiller trucks**)





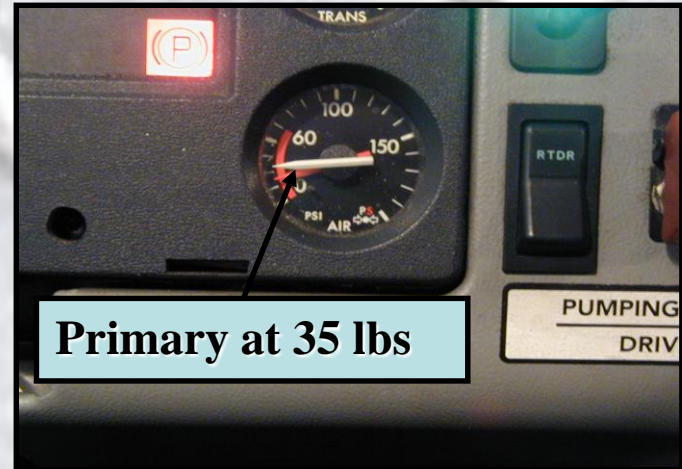
# D.O.T Brake Test

- After one minute you will start next step
- Start fanning the brakes
- Tell instructor “At approximately **60 to 90 lbs** I will get a low air warning light and buzzer
- When buzzer and light activate keep fanning brake



# D.O.T Brake Test

- After bell and buzzer activate keep fanning brake pedal
- Tell Instructor “At approximately 20 to 40 psi my protection valve will pop”
- Keep fanning until it pops
- Once valve pops stop fanning brake





# D.O.T Brake Test

- After protection valve pops stop fanning brake
- You will now start engine
- Air pressure must return to **120 lbs** within **90** secs at **1200 RPM**
- Ask instructor to time you

Note: Do not touch protection valve once you start the DOT brake test. If you touch it you fail



# D.O.T Brake Test

- After starting the engine and waiting for pressure to reach **120 lbs within 90 secs.**
- Tell instructor that all gauges are at working pressures
- After air pressure reaches **120 lb** you may pick up your wheel chock and place unit into drive then reverse to show inspector that the spring brake works.



- **NOTE: Do not step on throttle let engine tug at brakes at idle**



# MCFRS Brake Check

## Air Compressor

### C.O.L.A

- **C=** Air Compressor Cut-In
- **O=** Air Compressor Cut-Out
- **L=** Low Pressure Warning
- **A=** Air Leakage Rate

### ORDER

- (1) Cut in pressure
- (2) Cut out Pressure
- (3) Low Pressure Warning
- (4) Air Leakage Rate



# Air Compressor

## C.O.L.A.

- **C=Cut in Pressure** With motor running slowly fan brake, watch air gauge drop. When gauge reaches about **100psi** compressor will come on stopping air drop age. This is the compressor cut in pressure. Any compressor which fails to cut in before **95psi** will be reported to mechanic.
- **O=Cut out Pressure** With motor still running watch the air gauge rise and when you hear the air discharge that is the compressor cut out pressure. This will happen between **120 to 135psi**. Any higher pressure cut out will be reported to mechanic. Now shut down the engine





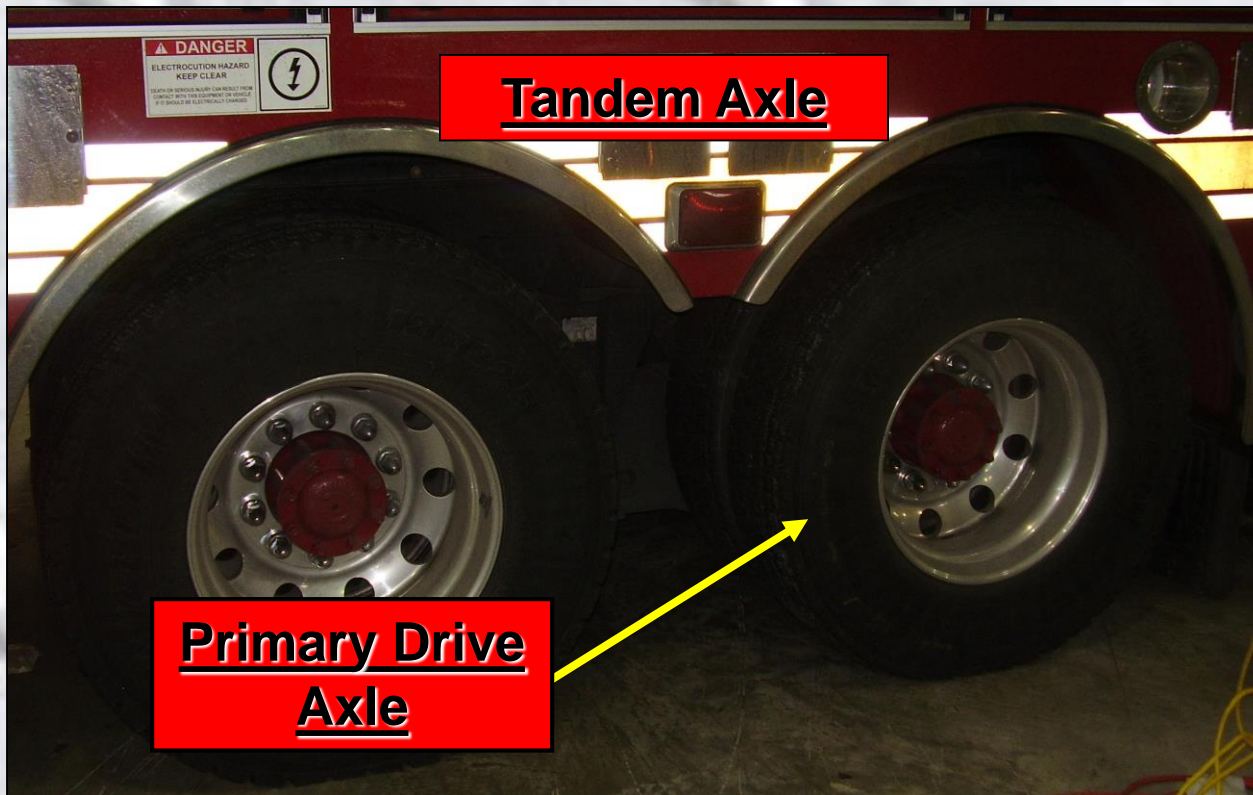
# Air Compressor

## C.O.L.A.

- L=Low Pressure warning With engine shut down but ignition on start fanning brake. When air pressure gauge reaches approximately 90psi you will get a low pressure light and buzzer. Any light or buzzer which fails to activate below 60psi will be reported to mechanic.
- A=Air Leakage rate With engine shut down air leakage will be less than 3 (three) psi per minute. This is with foot on or off brake pedal. 4 (four) psi in tiller trucks



# Axle Interlock, Differential Lock      Off Road Traction





# Axle Interlock



- When the axle interlock is off only the rear wheels have power to them
- When the axle interlock is engaged both sets of wheels have equal power
- The axle interlock acts as a third differential

# Differential Lock



- On your drive axle only the right wheel has constant power
- When you engage the differential lock you have power to both wheels
- This is known as posi traction



# Off Road Traction Control



- When you turn the switch for the off road traction you are actually turning off a component.
- Under normal driving if the ATC detects wheel slippage it tries to slow down the wheel either by brake or de-powering the engine
- The Off road traction switch takes this function away allowing for wheel spin

# Warning

- When you turn on the inter-locks and differential lock the truck will follow the contour of the land in a wheel spin situation.
- If the truck is on a slight left hand lean the rear of the truck will walk to the left.
- So use the locking devices with care !!!!





- Add Traction Control & Axle Interlocks
- Fuse Boxes
- On Spots
- Manual chains
- Start Up procedures Pierce Gauge Sweep

